

REMARKS

In this Response, Applicant amends claims 1 and 3-4, and cancels claims 2, 6-10 and 12. Claim 11 has been previously canceled. No new matter has been added, and no new issues are raised. Support for the claim amendments can be found at least in previously presented claim 2.

After entry of this amendment, Claims 1 and 3-5 are pending, of which claim 1 is independent. Applicant respectfully submits that all of the pending claims are in condition for allowance.

I. The Claimed Invention

Exemplary embodiments of the claimed invention provide a stack (12) of a polymer electrolyte fuel cell (10) which is immersed, in a stack container case (14), in a liquid coolant (108) such as an organic solvent, and the stack is operated in this state. The stack (12) whose temperature has risen by heat energy produced by the operation is cooled by the liquid coolant (108). The liquid coolant (108) which has cooled the stack (12) vaporizes, and is condensed by a condenser (16). Then, the liquid coolant returns to the stack container case (14).

II. Double Patenting Rejection

Claims 1-12 are provisionally rejected on the grounds of non-statutory obviousness-type double patenting as being unpatentable over claims 1-9 of co-pending U.S. Patent Application No. 10/584,390. Applicant respectfully defers addressing the double patenting rejection until all other substantial issues are resolved in the instant application.

III. Claim Rejections under 35 U.S.C. § 103(a)

Claims 1-6 are rejected under 35 U.S.C. § 103(a) as being unpatentable over JP 2002-190313 to Kususe (hereafter “Kususe”) in view of U.S. Patent No. 3,741,292 to Aakalu et al. (hereafter “Aakalu”). Applicant respectfully traverses the 35 U.S.C. § 103(a) rejection for the reasons set forth below.

A. Claim 1

Applicants amend independent claim 1 to recite the subject matter formerly found in dependent claim 2. Specifically, Applicants amend independent claim 1 to recite *wherein the liquid coolant is boiled into vapor in the nucleate boiling state*. Applicants respectfully submit that Kususe and Aakalu, alone or in any reasonable combination, do not disclose or suggest at least this feature of claim 1.

In the Office Action at page 4, the Examiner recognizes that Kususe as modified by Aakalu does not disclose that the fuel cell includes a liquid coolant that is boiled into vapor in the nucleate boiling state. The Examiner states that this limitation, which was formerly found in claim 2, does not limit claim 1 because “claims 2-5 … are directed to a manner of operating the disclosed reactor,” but “neither the manner of operating a disclosed device nor [the] material or article worked upon further limit an apparatus claim.” The Examiner appears to be arguing that claims 2-5 depend from an apparatus claim, but recite a method of operating the apparatus, and accordingly may not further limit the independent claim.

However, claim 1 (from which claims 2-5 depend) is a method claim, not an apparatus claim. Accordingly, a feature such as the recited boiling of liquid coolant in the nucleate boiling state can further limit claim 1. The apparatus claims (6-10 and 12) have been canceled in order to expedite prosecution.

Because the Examiner recognizes that the combination of the cited references do not disclose the *nucleate boiling state* now recited in claim 1, Applicants respectfully submit that claim 1 is in condition for allowance.

B. Claims 3-5

Claims 3-5 depend from independent claim 1 and include all of the features of claim 1. In addition, the Examiner recognizes that the combination of Kususe and Aakalu does not disclose the features of claims 3 and 5.

Therefore, for the reasons set forth above, Applicant respectfully submits that the Kususe and Aakalu references, alone or in any combination, fail to disclose or suggest each and every feature of claims 3-5. Accordingly, Applicant respectfully requests reconsideration and withdrawal of the 35 U.S.C. § 103(a) rejection of claims 3-5.

Further, claim 3 recites that *a liquid having a boiling temperature lower than an operating temperature of the stack by 10 – 25 °C is used as the liquid coolant*. Applicants respectfully submit that one of ordinary skill in the art would not modify the Kususe reference to use a liquid coolant having a boiling temperature lower than the operating temperature of the stack by 10-25°C.

The Kususe reference specifically teaches that a liquid having a high flash point should be used as a liquid coolant (Kususe at paragraph [0016]). In the examples of Kususe, a liquid having a flash point of 200 – 300 °C is used, while the fuel cell operates at about 100°C.

Because a mixture's flash point is related to the mixture's boiling point, the use of a liquid having a high flash point will inherently involve a liquid having a high boiling point. For example, Kususe uses dimethyl silicone oil as an insulating fluid. Dimethyl silicone oil is specifically known for its high boiling point, which is typically greater than 149°C (see, e.g., U.S. National Oceanic and Atmospheric Administration Database of Hazardous Materials at <http://cameochemicals.noaa.gov/chris/DMP.pdf>). Whereas the present claims recite a liquid with a boiling temperature that is lower than the operating temperature of the stack by 10-25°C, Kususe specifically teaches the use of a high flash point (and therefore high boiling point) coolant, and in the example given in Kususe the insulating fluid has a boiling point that is more than 49°C (or about 50%) greater than the operating temperature of the fuel cell.

Because Kususe teaches the use of a high flash point, and therefore high boiling point, fluid in order to eliminate the danger of ignition (Kususe at paragraph [0016]), Kususe directly teaches away from the use of a low boiling point (and therefore lower flash point) liquid, as recited in claim 3.

C. Claims 2, 6-10, and 12

As claims 2, 6-10, and 12 are canceled herein, Applicants respectfully submit that the rejection of these claims is moot.

CONCLUSION

In view of the foregoing arguments, Applicant believes that the pending application is in condition for allowance. Should the Examiner feel that a teleconference would expedite the prosecution of this application, the Examiner is urged to contact the Applicant's attorney at (617) 227-7400.

Any fee due is authorized to be charged to our Deposit Account No. 12-0080, under Order No. TOW-151US from which the undersigned is authorized to draw. If a requisite petition does not accompany this response, the undersigned hereby petitions under 37 C.F.R. § 1.136(a) for an extension of time for as many months as are required to render this submission timely.

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Respectfully submitted,

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